The interfaces of the layers $\sigma_{k+1/2}(k=1, \ldots, K-1)$ should be chosen such that (i) $\sigma_k=\sqrt{\sigma_{k-1/2}\sigma_{k+1/2}}$ (for $k=2, \ldots, K$); σ_1 can be any value less than $\sigma_{1\frac{1}{2}}$ but $\sigma_1=\sigma_{1\frac{1}{2}}/e$ (e=2.71828) is recommended, (ii) $\frac{1}{2}(\sigma_{k+1/2}+\sigma_{k-1/2})\, \delta_k \ln \sigma/\delta_k\sigma$ should be as close to unity as possible, where $\delta_k \ln \sigma$ for $k=1$ is assumed to be equal to $2(\ln \sigma_{1\frac{1}{2}}-\ln \sigma_1)$.

2) Hydrostatic relation (revision of (3.8A) and (3.9) in [1]):

$$\delta_k\phi=-RT_k\delta_k \ln \sigma \tag{5.1}$$

or

$$\phi_k-\frac{\delta_k(\phi\sigma)}{\delta_k\sigma}=RT_k\left(\frac{\sigma_{k+1/2}+\sigma_{k-1/2}}{2}\,\frac{\delta_k \ln \sigma}{\delta_k\sigma}\right)\equiv R\tilde{T}_k \tag{5.2}$$

Here, ϕ_k is related to $\phi_{k\pm1/2}$ by

$$\phi_{k\pm1/2}=\phi_k\mp RT_k(\delta_k \ln \sigma)/2$$

which insures that $\phi_k=\frac{1}{2}(\phi_{k+1/2}+\phi_{k-1/2})$.

3) Pressure gradient force: The revised forms of this term for version I in [1] are $-L'_\lambda(P_*, \phi_p)$, and $-L'_\theta(P_*, \phi_p)$, where ϕ_p is the geopotential of a pressure surface P. The value ϕ_p is obtained from the heights of the nearest sigma surfaces by using an interpolation formula which is consistent with (5.1). The modified forms for version II in [1] are $-P_*G'_\lambda(\phi_p)$ and $-P_*G'_\theta(\phi_p)$.

4) Thermodynamics equation and formula for ω: Modified form of (3.3A) in [1]:

$$\frac{\partial}{\partial t}\left(P_{*0}T_0\right)=-D\left(\frac{T_l+T_0}{2}\right)+\frac{R}{c_p}\,T_0\omega_0\frac{\delta_k \ln \sigma}{\delta_k\sigma}+\frac{P_{*0}}{c_p}\hat{q}+\left(F_T\right)_0.$$

Modified form of (3.7A) in [1]:

$$\omega_{0k}=P_{*0}\,\frac{\bar{\omega}_{k+1/2}+\bar{\omega}_{k-1/2}}{2}+\frac{\sigma_{k+1/2}+\sigma_{k-1/2}}{2}\left[\frac{\partial P_{*0}}{\partial t}\right.$$
$$+u_0\left\{L'_\lambda\left(P_*, \phi_p\right)-L_\lambda\left(P_*, \phi_\sigma\right)\right\}\Big/R\tilde{T}_0$$
$$\left.+v_0\left\{L'_\theta\left(P_*, \phi_p\right)-L_\theta\left(P_*, \phi_\sigma\right)\right\}\Big/R\tilde{T}_0\right]$$

for version I.

$$\omega_{0k}=P_{*0}\,\frac{\bar{\omega}_{k+1/2}+\bar{\omega}_{k-1/2}}{2}+\frac{\sigma_{k+1/2}+\sigma_{k-1/2}}{2}\left[\frac{\partial P_{*0}}{\partial t}\right.$$
$$+\,u_0P_{*0}\left\{G'_\lambda\left(\phi_p\right)-G_\lambda\left(\phi_\sigma\right)\right\}\Big/R\tilde{T}_0$$
$$\left.+v_0P_{*0}\left\{G'_\theta\left(\phi_p\right)-G_\theta\left(\phi_\sigma\right)\right\}\Big/R\tilde{T}_0\right]$$

for version II. Here, ϕ_p and ϕ_σ are the geopotentials of a pressure surface and a sigma surface, respectively, and $R\tilde{T}$ is a quantity defined in (5.2).

5) Finally, in regard to the grid system used, we recommend the use of a system which has no grid points at the Poles. Otherwise, the surface pressure at the Pole tends to be inconsistent with the meridional pressure gradient in surrounding latitudes due to a variation in the weights involved in the estimation of pressure gradient force by the box method. Moreover, removing the polar boxes makes the programming simpler. In this case, the numerical schemes for the northernmost or southernmost boxes take forms similar to the ones for other boxes by considering that the areas of the poleward interfaces of these boxes are zero.

Note Added in Proof—The recent results suggest that the present scheme still tends to cause small-scale irregularity of the flow pattern at the highest level over the steep slopes of mountains. Further improvement of the computation scheme is desired.

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Comments on "A Comparison of the Climate of the Eastern United States During the 1830's With the Current Normals"

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In his recent article, Wahl [1] indicated that: "A comparison of climatic data for the eastern United States from the 1830's and 1840's with the currently valid climatic normals indicates a distinctly cooler, and in some areas, wetter climate in the first half of the last century."

There is additional evidence which indicates that precipitation was heavy in the Great Lakes Region for a number of years in the 1830's. Most or all of the Great Lakes reached unusually high levels in 1838. For many years all of the charts issued by the U.S. Lake Survey for the benefit of navigators and others included an entry recording the high water of the year 1838. This information is no longer included, perhaps because of some doubt as to the accuracy of the early records of water levels.

But from [2]: "Very fortunately for these comparisons the remarkably high stage of water in the summer of 1838 was generally noticed, and on three of these lakes referred to permanent bench marks. These were at Charlotte, Lake Ontario, by Prof. Dewey; Cleveland, Lake Erie, by Col. Whittlesey; and Milwaukee, Lake Michigan, by Dr. Lapham. We thus have a common plane of reference and can easily compare them and the others."

And from [3]: "The level of each of the Great Lakes depends upon the balance between inflow and outflow. The major source of water to the system is from precipitation, which normally averages 31 in. per year. Two-thirds is returned to the air by evaporation, leaving about one-third for river outflow When either high or low water supplies occur for an extended period, corresponding extremes in the levels and flows develop."

Table 1 is a comparison of the high water of 1838 with other data:

If it had not been for man-made changes affecting the level of Lake Michigan-Huron (dredging in the St. Clair-Detroit River system), the highest monthly level 1860–1967 would probably have been in August 1952, when it was reported as 580.96 ft. The average yearly precipitation 1880–1884 was 38.64 in. prior to the high level of June 1886.

TABLE 1.—*Lake levels—1955 International Great Lakes datum*

Lake	Approximate high water of 1838 (ft.)	Highest monthly level, 1860–1967 (ft.) (mo., yr.)	Highest monthly level, 1967 (ft.)	Average yearly precipitation [1] 1931–1960 (in.)	Average yearly precipitation [1] 1950–1951 (in.)
Michigan-Huron	583	581.94, June 1886	578.38	31.34	36.40
Erie	573.5	572.76, May 1952	571.03	34.02	40.32
Ontario	248	248.06, June 1952	246.05	32.04	35.98

[1] Land area of drainage basin.

And there is evidence that the high water in 1838 was the highest for many years. It was reported [4] that because of the high water, a great number of forest trees were destroyed, many of which were one to two centuries old. The flood was supposedly greater than for a century, with orchards killed along the St. Clair and Detroit Rivers.

Thus it can be concluded that the precipitation was unusually heavy in much or all of the Great Lakes Region for a number of years in the 1830's.

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